NASA Procedural Requirements

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COMPLIANCE IS MANDATORY

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Subject: NASA Program and Project Management Processes and Requirements

Responsible Office: Office of the Chief Engineer

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APPENDIX E. CADRe Data Requirement Description

USE: The Cost Analysis Data Requirement (CADRe) documents the programmatic, technical, and life cycle cost information for Category I and Category II Flight Systems and Ground Support Projects. It is the NASA version of the Department of Defense Cost Analysis Requirements Document (CARD). NASA's CADRe combines and streamlines the contents of formerly separate DRDs - the CARD and the Life Cycle Cost Estimate (LCCE). The CADRe is for both internal project use and for independent cost estimating. CADRe is part of an overall Agency focus on performing best practices in cost estimating called Continuous Cost Risk Management (CCRM).

Typical projects will make five CADRe submissions across the project life cycle (see Submissions below). The NASA Project Manager is responsible for the CADRe. The Project Manager may develop the CADRe within the Project Office or use the CADRe as a DRD on contract(s). Because the CADRe collects Full Cost information, it is likely that the project will have to perform final integration of a contractor prepared CADRe to include all Full Cost information.

OTHER DRD INTERRELATIONSHIP: Work Breakdown Structure; Earned Value Management Report; Integrated Master Schedule; Risk Management Plan & Reports; Phase Implementation Plans; PRA Plans and Reports, 533 Reports.

REFERENCES: NASA Cost Estimating Handbook (http://www.ceh.nasa.gov); DoD 5000.4M (CARD); DI-MGMT-81466, CPR DID; DD Forms 2734/1-5 (CPR Formats) (http://www.dior.whs.mil)

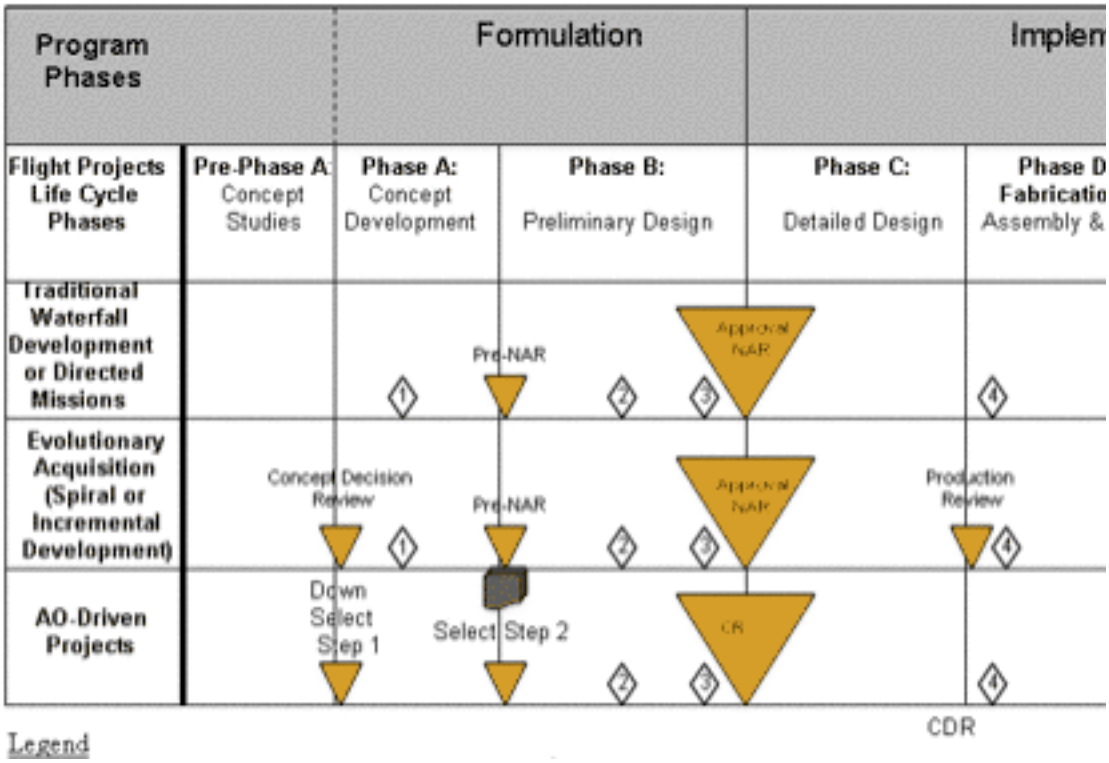

Figure E-1. Flight Systems and Ground Support Projects
CADRe Submissions Timeline

FIRST SUBMISSION: The initial CADRe submission shall occur 90 days prior to the Preliminary Non-Advocate Review (Preliminary NAR) as referenced in Figure E-1. For AO (Announcement of Opportunity)-driven projects, in lieu of this initial CADRe, copies of the selected winning proposal and Concept Study Report may be submitted at the end of Step 2 down selection.

SUBSEQUENT SUBMISSIONS: The CADRe shall be submitted 90 days prior to the following events: Non-Advocate Review (NAR), Critical Design Review, and Production Reviews (for projects using an evolutionary acquisition approach). The CADRe shall also be submitted 180 days after launch, and one final CADRe at the end of the planned project lifecycle (Phase E/F).

DOCUMENT FORMATS: The use of Microsoft Office™ products (Word, Excel, PowerPoint, and Project) is preferred. At www.ceh.gov, there are three downloadable Microsoft Excel CADRe Report formats (the Hardware Metrics Report, the Software Metrics Report and the WBS Cost Report). However, project formats are acceptable. Most, if not all, CADRe information can be extracted from other project documents and included in the CADRe. Projects are encouraged to provide other supporting and supplemental documentation[46] to the CADRe as these documents are helpful in understanding project cost.

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[46] Examples include: Project Plan, Systems Engineering Plan, Work Breakdown Structure and Dictionary, Integrated Master Schedule, requirements documents, parts program, and major review documentation/briefings

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DELIVERY METHODS: The CADRe and supporting documents may be delivered on CDs or otherwise made electronically accessible, for example, from a web page.

DISTRIBUTION: As a minimum, the CADRe and supporting documents shall be delivered to the Headquarters Office of the Chief Engineer (IPAO/Cost Division) and the Headquarters Office of the Chief Financial Officer (Cost Analysis Division). Further distribution is at the discretion of the project.

PREPARATION INSTRUCTIONS: The guidance contained in this document describes the contents of the CADRe. It is a guide for content rather than format. Projects are encouraged to extract existing project documentation for appropriate sections of the CADRe. These extracts shall be included in the CADRe and/or in the attached CADRE Hardware Metrics Report, Software Metrics Report and WBS Cost Report in order to provide a complete, stand-alone CADRe document.

The body of the CADRe consists of three parts. Part A contains general descriptive information. Part B contains hardware and software technical parameters necessary to estimate the project's life cycle cost. The Hardware Metrics Report and Software Metrics Report formats at http://www.ceh.gov are available to use directly or as a

content guide for Part B. Part C contains the project's life cycle cost estimate (LCCE). The WBS Cost Report available at http://www.ceh.gov is available to use directly or as a content guide for Part C. The Project Manager is responsible for collecting the inputs from the various participants including Full Cost elements and submitting an integrated CADRe.

The level of detail reported in the CADRe will depend on the maturity of the project in the life cycle. The Hardware Metrics Report, the Software Metrics Report and the WBS Cost Report provide a template of information that would typically be provided at the NAR (for example, at WBS Level 4). These Reports may be tailored to provide less detail for projects earlier in the life cycle (for example, WBS Level 3 at Preliminary NAR). The project shall submit lower-level information in subsequent CADRe submissions when and if such information becomes readily available (for example, WBS Level 5 at CDR). Prior to CADRe submittals, representatives of the Headquarters Cost Analysis Division, the applicable Mission Directorate, and Program Office, will meet with the Project Manager to provide guidance on the scope, schedule, parties involved in CADRe preparation, CADRe tailoring, WBS reporting levels and WBS mapping.

The Freedom of Information Act (FOIA) law defines . confidential business information as data that provides visibility into elements of cost (labor rates, overhead rates, G&A rates, profit rates and similar rates and factors). The CADRe reports costs rolled into the project WBS without visibility into elements of cost/rates and factors. Likewise, the CADRe does not collect proprietary technical information such as insight into production processes, etc. Rather, the CADRe only collects performance specifications as technical cost drivers. Therefore, NASA intends that no proprietary, confidential or sensitive business information be included in the CADRe and that CADRe submissions need not be marked as "proprietary", "sensitive" or display other confidential business information markings.

The subsequent paragraphs describe the information that shall be contained in each part of the CADRe.

Part A - General Descriptive Information (in narrative form supplemented by tables, figures and graphics as appropriate)

- **Description -** Provide a top-level description of the system, including functions to be performed, measurements to be obtained and key performance parameters. A functional block diagram and/or photograph or drawing of the system (with major elements identified) shall be provided. For CADRe purposes, document the baseline project description that is being used as the basis for budget forecasts (i.e. excluding other options that might still be in the trade space at any given point in the project evolution).
- **Mission/Objective -** Describe the overall mission(s) of the system, including interfaces and functional relationships to other systems. Include a description of the concept of operations (CONOPS) for the system.
- **Configuration -** Provide complete WBS and WBS Dictionary at the appropriate level of detail. The required NASA Standard WBS through Level 2 for flight systems and ground support projects is shown below. The NASA Cost Estimating Handbook contains a WBS template for flight systems and ground support projects down to Level 4 to assist projects in forming the WBS. If a project is not able to conform to the NASA Standard WBS and/or the CADRe Level 4 WBS, a mapping shall be provided that maps the project WBS at Level 4 and above to the NASA Standard/CADRe WBS. It is recognized that it may occasionally be necessary to carry an element at a higher level in the project WBS than it will appear in the CADRe WBS (for example, a foreign-contributed instrument may need to appear at WBS Level 2 in the project for political purposes but can be mapped to Level 3 in the CADRe WBS).

Table 1 - NASA Standard Level 2 WBS for Flight Systems and Ground Support Projects

Program Management
Systems Engineering
Safety and Mission Assurance
Science/Technology
Payload
Aircraft/Spacecraft
Mission Operations
Launch Vehicle/Services
Ground Systems Development
System Integration Assembly & Test
Education & Public Outreach

- **Project Management and Systems Engineering -** Describe the responsibilities and functions of the project office. Include current and anticipated funding levels (by Government Fiscal Year) for all project elements and funding lines/sources.
- **Acquisition Plan -** Describe the contract type(s), acquisition strategy and schedule for system development, procurement and implementation. Provide an Integrated Master Schedule (IMS) that includes major milestone dates for SRR (System Requirements Review), PDR (Preliminary Design Review), CDR (Critical Design

Review), LRR (Launch Readiness Review), etc. Lower-level schedules should be included when known. Describe contract type(s), fee structure(s) and any unusual acquisition strategies assumed or corporate investments. If known, identify contractors and major subcontractors (or NASA in-house organizations) and their products at a summary WBS level. Identify any government or foreign partners and the hardware and/or software elements that will be furnished by the partners. For items such as joint-use of facilities, availability and schedule constraints should be identified along with any cost-sharing provisions.

- **Heritage -** In Part A, provide at a summary level, any heritage or analogous systems that are being used to reduce development/production costs. Describe any ECP/ECO (Engineering Change Proposal/Engineering Change Order) activity that modified original system performance requirements from the previous CADRe submission (in order to understand requirements creep/evolution). Lower-level WBS heritage is documented in Part B on the Hardware Metrics Report and Software Metrics Report.
- **Test Plan -** If available within the current phase of the program, describe all testing to be conducted by the developing organization(s) and/or other agencies to include equipment, subsystem and system-level testing. Testing includes assessment of functionality, reliability, utility, operational effectiveness, supportability, etc.
- **Project Risks -** Identify programmatic and technological aspects of the project that present potential or demonstrable risks to the schedule and/or budget of the project and their effects on specific WBS elements. Include an identification of cost-correlated WBS elements. Describe risk mitigation philosophy and processes. As the project proceeds through its life cycle, this information should be updated to document the interim results of risk mitigation and to include any risks identified since the last CADRe submission.
- **Track to Prior Release -** Summarize changes made since submission of the previous CADRe. If no changes occurred since the last submission, the Project Manager is not required to resubmit, but to notify the Distribution list provided earlier. The CADRe will document evolution in the project, specifically addressing changes in cost drivers and cost.

Part B - Technical Data

The project shall provide hardware and software metrics data that will permit an independent team to estimate project cost. To report Part B Technical Data, use the latest CADRe Hardware and Software Metrics Reports directly or as a content guide (available at http://www.ceh.gov). The CADRe Hardware and Software Metrics Reports document the cost driver metrics that the NASA cost estimating community uses to estimate project cost and to develop future cost models. The Project Manager shall coordinate with the Headquarters Cost Analysis Division regarding significant departures from providing the majority content of these reports.

Part C - Life Cycle Cost Estimate

This part of the CADRe contains the LCCE.

Life Cycle Cost Estimate Documentation

The CADRe WBS Cost Report can be used directly to report Part C life cycle costs or be used as a content guide. The LCCE consists of design, development, test and evaluation (DDT&E) and production through the end of operations and disposal. The LCCE in this section is the Project Manager's estimate. It should be consistent with the basis of estimate contained in Parts A and B of the CADRe (which may be used by independent cost estimating organizations within NASA).

NPR 7120.5C requires projects to take cost risk into account when performing cost estimates. The costs reported in Part C shall be risk-adjusted costs consistent with the Continuous Cost Risk Management (CCRM) process as described in the NASA Cost Estimating Handbook. The LCCE documentation shall identify where cost reserves are included in the WBS accounting.

The LCCE documentation shall also include:

a. a. Sufficient information to allow an independent estimator/analyst to understand how the estimate was constructed, understand the impacts of key assumptions and inputs, and determine a level of confidence in successfully completing the system(s) within the estimated cost.

b. b. LCCE team memberships, including basic functional organizational memberships and names of cost experts.

c. c. LCCE methodologies and models used, by phase of project: System design cost analysis methodology and parametric or other cost models, analogy, or "grass roots/WBS-based"(or combinations). Provide information on cost and economic models (especially, information concerning model validation, history of successful use, configuration version), backup and supporting data, ground rules and assumptions.

d. d. The WBS Cost Report format provides for a separation of non-recurring and recurring cost assumptions. The NASA Cost Estimating Handbook provides guidance on defining non-recurring and recurring costs. However, if a project believes it cannot reasonably separate non-recurring and recurring cost, total cost may be reported without such a separation.

e. e. A WBS display of total cost in tabular form to the agreed upon WBS Level for the phase of the project (for example, WBS Level 3 at the Preliminary NAR and WBS Level 4 or 5 at the NAR). A fiscal year time-phased display of life cycle cost shall be provided at least to WBS Level 2. At any given milestone (Preliminary NAR, NAR, etc.), past years' costs are "actuals", while future years' costs are estimates. Obviously, the final CADRe at the end of Phase E/F contains all actual costs. See the WBS and Cost Report at http://www.ceh.gov to use directly or for sample content.

f. f. Narrative identification and explanation for cost growth occurring since the last CADRe submission stemming from all technical, programmatic, and project configuration sources delineated in accordance with the following two general categories:

- Risk-Driven cost and schedule growth is cost and schedule growth, overruns or funded changes, linked to technical risk drivers (e.g., technology maturity, design/engineering, complexity, integration, etc.) and key engineering performance parameters.
- Externally-Driven cost and schedule growth is cost and schedule growth, overruns or funded changes, linked to external factors (e.g., requirements changes, technical enhancements not driven by risk, perturbations to budgets by external agents causing schedule changes, labor strikes, business base changes, etc.).

(NOTE: Sources for both categories of this cost and schedule growth can be specifically identified in the Earned Value Management Cost/Schedule Performance Report variance analysis reporting - Cost Performance Report Format 5).

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